

Freshwater crabs (Brachyura: Potamoidea: Potamonautidae) from the rainforests of the Central African Republic, Central Africa

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Abstract.—A collection of freshwater crabs of the family Potamonautidae from the Central African Republic made recently by the Central African Republic Expedition of the American Museum of Natural History, New York, comprised four species in two genera. The collection included two species of *Potamonautes* MacLeay, 1838, *P. paecilei* A. Milne-Edwards, 1886, and *P. ballayi* A. Milne-Edwards, 1886 and two species of *Sudanonautes* Bott, 1955, *S. africanus* A. Milne-Edwards, 1869, and *S. sangha*, new species. Only six species of freshwater crabs have been previously reported to occur in the Central African Republic. The addition of *S. africanus* and *S. sangha* brings to eight the number of species of freshwater crabs reported from that country.

The freshwater crabs reported on here were collected during a systematic survey of the freshwater and terrestrial Mollusca of the Central African Republic made by the American Museum of Natural History. The survey aimed to document biodiversity, to catalogue introduced species, and to identify intermediate hosts that may serve as vectors of parasite larvae responsible for disease in humans and domestic animals. The freshwater crab collections were made in the vicinity of the village of Bayanga, Central African Republic, which lies on the banks of the Sangha river in a remote and largely roadless area close to southern Cameroon, the Republic Populaire du Congo (formerly French Congo), and Gabon. This region includes an area of tropical forest that supports elements of both the West African and Zaire river basin faunas, and consequently has an unusually high biodiversity.

The collection of freshwater crabs obtained included two species of *Potamonautes* MacLeay, 1838, and two species of *Su-*

danonautes Bott, 1955. Both of these genera belong to the exclusively African freshwater crab family Potamonautidae Bott, 1970. The two species of *Potamonautes* are *P. ballayi* (A. Milne-Edwards, 1886) and *P. paecilei* (A. Milne-Edwards, 1886). Both are little-known species and their diagnostic characters are redescribed here. Additionally, a lectotype is herein designated for *P. paecilei*.

One of the species of *Sudanonautes* is clearly *S. africanus* (A. Milne-Edwards, 1869). This is a common and well-known species that was recently redescribed by Cumberlidge (1995a, 1999). The second species of *Sudanonautes* in the collection is superficially similar in some respects to *S. africanus*, *S. chavanesii* (A. Milne-Edwards, 1886), *S. faradjensis* (Rathbun, 1921), *S. floweri* (de Man, 1901), *S. granulatus* (Balss, 1929) and *S. aubryi* (H. Milne Edwards, 1853). However, the new specimen from the Central African Republic has a number of important characters that do not conform to the descriptions of any of these

species (Cumberlidge 1993, 1994, 1995a, 1995b, 1995c, 1995d; 1999). Although the specimen is a subadult female, and ideally an adult male is needed to make a definitive identification, a preliminary description is provided here, based on several unique somatic characters of the specimen. This new taxon is the eleventh species of *Sudanonautes* to be described (Cumberlidge 1999). Characters of the gonopods, male abdomen, and male chelipeds will be described when more material (including an adult male) becomes available.

Only six species of freshwater crabs have been previously reported to occur in the Central African Republic (Bott 1955, Cumberlidge 1999). These are: *Potamonautes ballayi* (A. Milne-Edwards, 1886), *P. paecilei* (A. Milne-Edwards, 1886), *P. dybowski* (Rathbun, 1904), *Sudanonautes faradjensis* (Rathbun, 1921), *S. floweri* (de Man, 1901) and *S. granulatus* (Balss, 1929). The addition of *S. africanus* and *S. sangha* new species in the present work brings to eight the number of species of freshwater crab reported from the Central African Republic.

Materials and Methods

Figures were prepared by capturing an image with a digital camera and completed using the programs Adobe Photoshop[™] and Adobe Illustrator[™] (Harvey 1999). The specimens are deposited in the American Museum of Natural History, New York, U.S.A. (AMNH). Abbreviations: Muséum national d'Histoire naturelle, Paris, France (MNHN); Muséum royale d'Afrique central, Tervuren, Belgium (MRAC); Biology, Northern Michigan University, Marquette, Michigan, U.S.A. (NMU); Senckenberg Museum, Frankfurt, Germany (SMF); cw, distance across the carapace at the widest point; cl, carapace length measured along the median line, from the anterior to the posterior margin; ch, carapace height (the maximum height of the cephalothorax); fw, front width measured along the anterior margin; s, thoracic sternite; e, thoracic episternite; s4/s5,

s4/s5, s5/s6, s6/s7, s7/s8, sternal sulci between adjacent thoracic sternites; s4/e4, s5/e5, s6/e6, s7/e7, episternal sulci between adjacent thoracic sternites and episternites; P1–P5, pereopods 1–5.

Systematic Account

Genus *Potamonautes* MacLeay, 1838

Diagnosis.—Postfrontal crest completely crossing carapace and meeting anterolateral margins at epibranchial teeth. Anterolateral margin always lacking intermediate tooth between exorbital angle and epibranchial tooth. Mandibular palp always two-segmented. Exopod of third maxilliped always with long flagellum. Terminal article of gonopod 1 short, about one-quarter to one-third as long as subterminal segment of gonopod 1. Terminal article of gonopod 2 a long flagellum about 0.5–0.75 times as long as subterminal segment of gonopod 2.

Remarks.—Bott (1955) revised *Potamonautes* and included 38 species and 14 subspecies, and erected 15 subgenera to accommodate these taxa. Since that work, a number of other species and subspecies have been described. These are *Potamonautes triangulus* (Bott, 1959), *P. brincki* (Bott, 1960) (Cumberlidge 1994, 1999; Stewart 1997a), *P. (Isopotamonautes) anchetiae machadoi* Bott, 1964, *P. (Lirrangopotamonautes) lirrangensis adeleae* Bott, 1968, *P. (I) senegalensis* Bott, 1970, *P. dentatus* Stewart, Coke, & Cook, 1995, *P. parvispina* Stewart, 1997b, *P. granularis* Daniels, Stewart, & Gibbons, 1998, and *P. reidi* Cumberlidge, 1999.

Bott (1955) assigned *Potamonautes ballayi* and *P. paecilei* to the subgenus *Longipotamonautes* Bott, 1955, which also included a number of other species of rainforest river crabs from Central Africa in which adult males have an elongated, highly arched right cheliped and sharp teeth on the anterolateral margins of the carapace: *P. vandenbrandeni* (Balss, 1936), *P. schubotzi* (Balss, 1914), *P. punctatus* Bott, 1955, *P. ballayi acristatus* Bott, 1955, and *P. ballayi gono-*

cristatus Bott, 1955. Although Bott (1955) recognised numerous subgenera of *Potamonautes* including *Isolapotmonautes*, *Platypotamonautes*, *Lirrangopotamonautes* and *Longipotamonautes*, we prefer here to follow Cumberlidge (1999) and use *Potamonautes* sensu lato for all species, pending a revision of the entire genus.

Potamonautes ballayi (A. Milne-Edwards, 1886)

Figs. 1, 2

Thelphusa Ballayi A. Milne-Edwards, 1886: 149.—A. Milne-Edwards, 1887:132, pl. 7, figs. 2, 2a.

Potamon (Potamon) ballayi: Rathbun, 1904: 294, pl. 12, fig. 9.—Rathbun, 1921:419–422, pl. 27–28, figs. 1, 10.

Potamon (Potamonautes) ballayi: Balss, 1936:174–177, figs. 9, 12–13.

Potamon ballayi: Chace, 1942:206.—Capart, 1954:827, fig. 3.

Potamonautes (Longipotamonautes) ballayi ballayi: Bott, 1955:244–245, pl. VII, figs. 2a–d, figs. 23, 73.

Type material and type locality.—Female holotype, Ngancin (=Nganchu = Ngabé), Republic Populaire du Congo (formerly French Congo), 03°18'S, 16°6'E, on opposite bank to Kwamouth, Democratic Republic of Congo (formerly Zaire), coll. Apr 1884, MNHN.

Material examined.—Central African Republic. 1 adult male, cw 18.8 mm (AMNH 17826), about 19 km from the village of Bayanga, Yobei (Yobé) river, depth 0.1 m, sandy shore near large dam made entirely of closely interwoven branches and vines, coll. J. Cordeiro, 18 Jun 1998.

Diagnosis.—Postfrontal crest not complete, epigastric lobes significantly separated from postorbital crests, and lateral ends of postorbital crests not quite meeting anterolateral margins (Fig. 1A). Exorbital angle produced into small pointed tooth; epibranchial tooth large, sharp, and pointing forward; anterolateral margin between exorbital angle tooth and epibranchial tooth smooth,

curving slightly outward, lacking intermediate tooth; anterolateral margin posterior to epibranchial tooth smooth, raised, curving inward over mesobranchial surface of carapace, and not continuous with posterolateral margin. Carapace height approximately equal to front width (ch/fw 1.07). Front very broad, measuring almost one half width of carapace (fw/cw 0.45) (Fig. 1B). Sidewall of carapace with distinct vertical sulcus, continuing downward in pterygostomial region, dividing sidewall into four parts. Exopod of third maxilliped with a long flagellum, ischium of third maxilliped smooth lacking vertical sulcus (Fig. 1D). First thoracic sternal sulcus s1/s2 absent; second sulcus s2/s3 deep, running horizontally across sternum; third sternal sulcus s3/s4 absent so that sternum in this region completely smooth (Fig. 1C). Thoracic episternal sulci s4/e4, s5/e5, s6/e6 and s7/e7 smooth, none marked by visible groove. Major cheliped of adult males distinct, with widely arched dactylus and propodus longer than carapace width (Fig. 1G). First carpal tooth of inner margin of carpus of cheliped large, slender, pointed; second carpal tooth pointed, half size of first tooth. Lateral inferior margin of merus of cheliped lined by small teeth, medial inferior margin of merus of cheliped smooth, with single large pointed distal meral tooth at distal end (Fig. 1J); superior surface of merus ridged by rows of short carinae (Fig. 1I). Terminal article of gonopod 1 short (about one-third as long as subterminal segment), longitudinal groove visible on dorsal and superior sides (but not on ventral side); entire terminal article slim, tubular, and directed outward at 45° angle to vertical, ending in wide tip forming distinct pointed process on medial side; lateral and medial folds on terminal article of gonopod 1 approximately equal (Figs. 2A–C). The adult size range of *P. ballayi* is between cw 28–30 mm.

Description.—For a detailed description and additional illustrations see Rathbun (1921) and Bott (1955). For a brief description of the type, see Capart (1954, fig. 3).

Remarks.—Rathbun (1921) recorded the

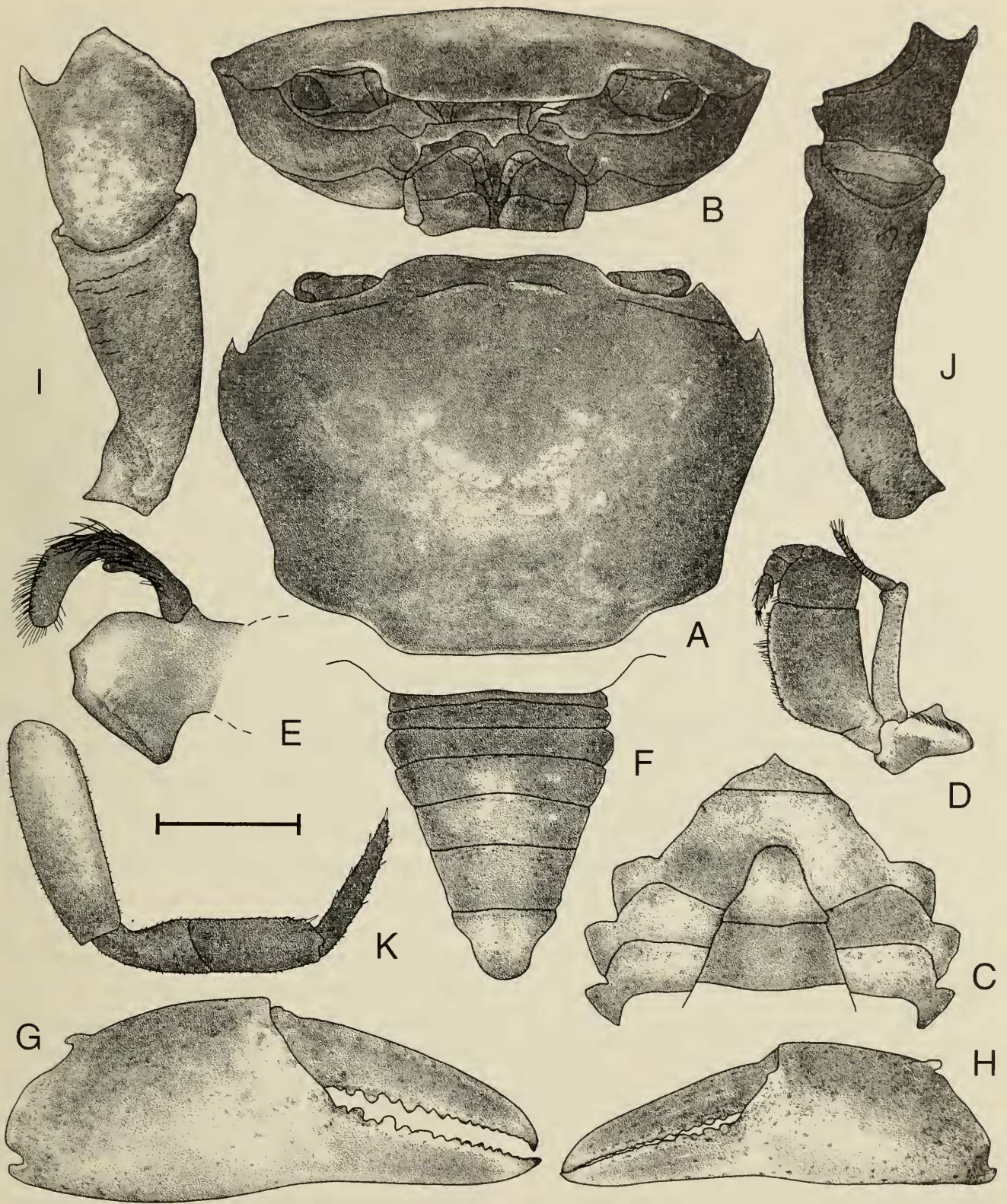


Fig. 1. *Potamonautes ballayi* (A. Milne-Edwards, 1886). Male, cw 17.3 mm, AMNH 17826. A, carapace and eyes, dorsal view; B, cephalothorax, carapace and eyes, frontal view; C, anterior sternum; D, left third maxilliped; E, left mandible; F, abdomen; G, right cheliped, frontal view; H, left cheliped, frontal view; I, carpus and merus of right cheliped, lateral view; J, carpus and merus of right cheliped, mesial view; K, left second pereiopod, lateral view. Scale = 1.6 mm (E), 3.3 mm (D, G-J), and 4.4 mm (A-C, F, K).

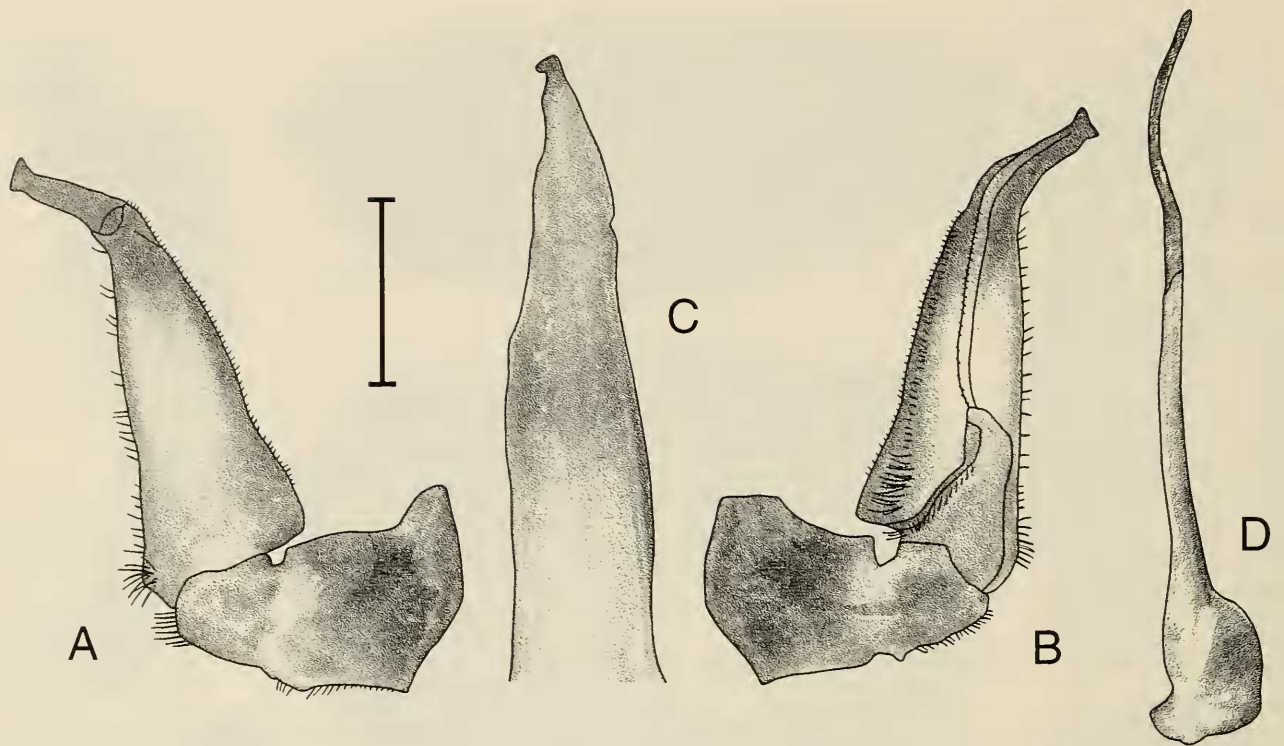


Fig. 2. *Potamonautes ballayi* (A. Milne-Edwards, 1886). Male, cw 17.3 mm, AMNH 17826. A, left gonopod 1, cephalic view; B, left gonopod 1, caudal view; C, distal portion of left gonopod 1, superior view; D, left gonopod 2. Scale = 0.80 mm (C), and 1.67 mm (A, B, D).

mandibular palp as three-segmented. This is an error, for it is clearly two-segmented (Fig. 1E), as is the case for all members of the genus, and, indeed all potamonautid African freshwater crabs (Cumberlidge 1999). Because the type of *P. ballayi* is a female, the gonopods were not illustrated in the first descriptive works on the species. Gonopod 1 of *P. ballayi* was subsequently illustrated by Rathbun (1921) who used a male (cw 26 mm, AMNH 3356) from Stanleyville (now Kisangani, Democratic Republic of Congo) and by Bott (1955), who used a male (cw 33 mm, MRAC 17413) from Karawa, Ubangi, Democratic Republic of Congo. Gonopod 1 of the male from the Central African Republic is shown here in more detail (Figs. 2A–C), and gonopod 2 of *P. ballayi* is illustrated for the first time (Fig. 2D).

Ecology.—The specimen from the Central African Republic was caught in shallow water (only 0.1 m deep) near a dam made entirely of closely interwoven branches and vines. Herbert Lang's field notes (in Rathbun 1921) record that *P. ballayi* is common in shallow forest streams around Stanleyville

(now Kisangani). Lang wrote that it is probable that *P. ballayi* can live out of water and that it is only dependent on a certain amount of moisture. When disturbed, crabs were reported to instantly cover themselves with mud and secure protection beneath any object.

Distribution.—Republic Populaire du Congo (formerly French Congo), Democratic Republic of Congo, and Gabon. The type locality of *P. ballayi* at Ngabé, Republic Populaire du Congo lies on the banks of the Zaire river opposite Kwamouth, Democratic Republic of Congo. The present study showed that *P. ballayi* is present in the Yobé river, a tributary of the Sangha river which drains into the Zaire river in a broad marshy area at Mossaka, Republic Populaire du Congo. For more localities see Rathbun (1921), Balss (1936), and Bott (1955).

Potamonautes paecilei (A. Milne-Edwards, 1886)
Fig. 3

Thelphusa paecilei A. Milne-Edwards, 1886:149

Parathelphusa paecilei: A. Milne-Edwards, 1887:143, pl. 7, figs. 1, 1a; Ortmann, 1897:300.

Potamon (Parathelphusa) paecilei: Rathbun, 1905:257, fig. 167.

Potamon paecilei: Chace, 1942:208.—Capart, 1954:841–842, figs. 34, 37.

Potamonautes (Longipotamonautes) paecilei: Bott, 1955:242–243, pl. VI, figs. 2a–d, text figs. 21, 71.

Type material and type locality.—Adult male lectotype, cw 32 mm (MNHN-B263), Central Africa, Republic Populaire du Congo (formerly French Congo), Latéké (=Lékéti), Alima river (14°56'E, 1°36'S), coll. M. de Brazzae.

Material examined.—Central African Republic. 1 adult female, cw 18.6 mm, (AMNH 17827), 17.3 km from the village of Bayanga (02°45'43"N, 16°14'12"E), Lossi creek, depth 1–2 m, bottom of the fine sand and mud, caught in net in swiftly moving black water, coll. J. Sullivan, 19 Jun 1998.—1 adult male, cw 20.7 mm (AMNH 18032), 17.3 km from the village of Bayanga (02°45'43"N, 16°14'12"E), Lossi creek, depth 1–2 m, bottom of fine sand and mud, caught in net in swiftly moving black water, coll. M. Lawrence, J. Sullivan, and local residents, 30 Jun 1998.

Diagnosis.—Postfrontal crest either complete or almost complete, wherein lateral ends of postorbital crests not quite meeting anterolateral margins (Fig. 3A). Exorbital angle produced into small, pointed, sharp tooth; epibranchial tooth large, pointed, directed forward; anterolateral margin between exorbital angle tooth and epibranchial tooth smooth, curving outward, lacking intermediate tooth; anterolateral margin posterior to epibranchial tooth with two sharp, forward-pointing teeth; margin otherwise smooth, continuous with posterolateral margin. Front very broad, measuring almost one-half width of carapace (fw/cw 0.45) (Fig. 3A, B). Carapace height approximately equal to front width (ch/fw 1.07). Exopod of third maxilliped with long flagellum, ischi-

um of third maxilliped smooth, lacking vertical sulcus (Fig. 3D). First thoracic sternal sulcus s1/s2 absent; second sulcus s2/s3 deep, running horizontally across sternum; third sternal sulcus s3/s4 absent; sternum in this region completely smooth. Episternal sulci s4/e4, s5/e5, s6/e6 and s7/e7 smooth, none marked by visible groove. Major cheliped of adult males distinct, with widely arched dactylus and a propodus longer than carapace width. First carpal tooth of inner margin of carpus of cheliped large, slender, pointed; second carpal tooth half size of first. Lateral and medial inferior margins of merus of cheliped lined by small teeth; single large pointed distal meral tooth at distal end (Fig. 3J); superior surface of merus ridged by rows of short carinae (Fig. 3I). Terminal article of gonopod 1 short (about one-third as long as subterminal segment), longitudinal groove visible on superior side, but not on dorsal and ventral sides; entire terminal article slim, tubular, curved; directed outward at an approximately 45° angle to vertical; ending in broadened upcurved tip; lateral and medial folds on terminal article of gonopod 1 approximately equal size. The adult size range of *P. paecilei* is between cw 28–30 mm.

Description.—See Bott (1955), and Capart (1954).

Remarks.—One of us (NC) has examined an adult male syntype (cw 32 mm) of *P. paecilei* (MNHN-B 263) from the Alima river, Latéké French Congo collected by M. de Brazzae. We designate this specimen here as the lectotype. A different male syntype (now paralectotype) of *P. paecilei* (cw 22.7 mm) was figured by Capart (1954). The characters of this species (Fig. 3) include a large forward-pointing epibranchial tooth; a large tooth (or two teeth) behind the epibranchial tooth on the anterolateral margin; an enlarged major cheliped in adult males with a widely arched dactylus and a propodus that is longer than the carapace width; a long sharp distal meral spine on the merus of the cheliped; and the ischium of the third max-

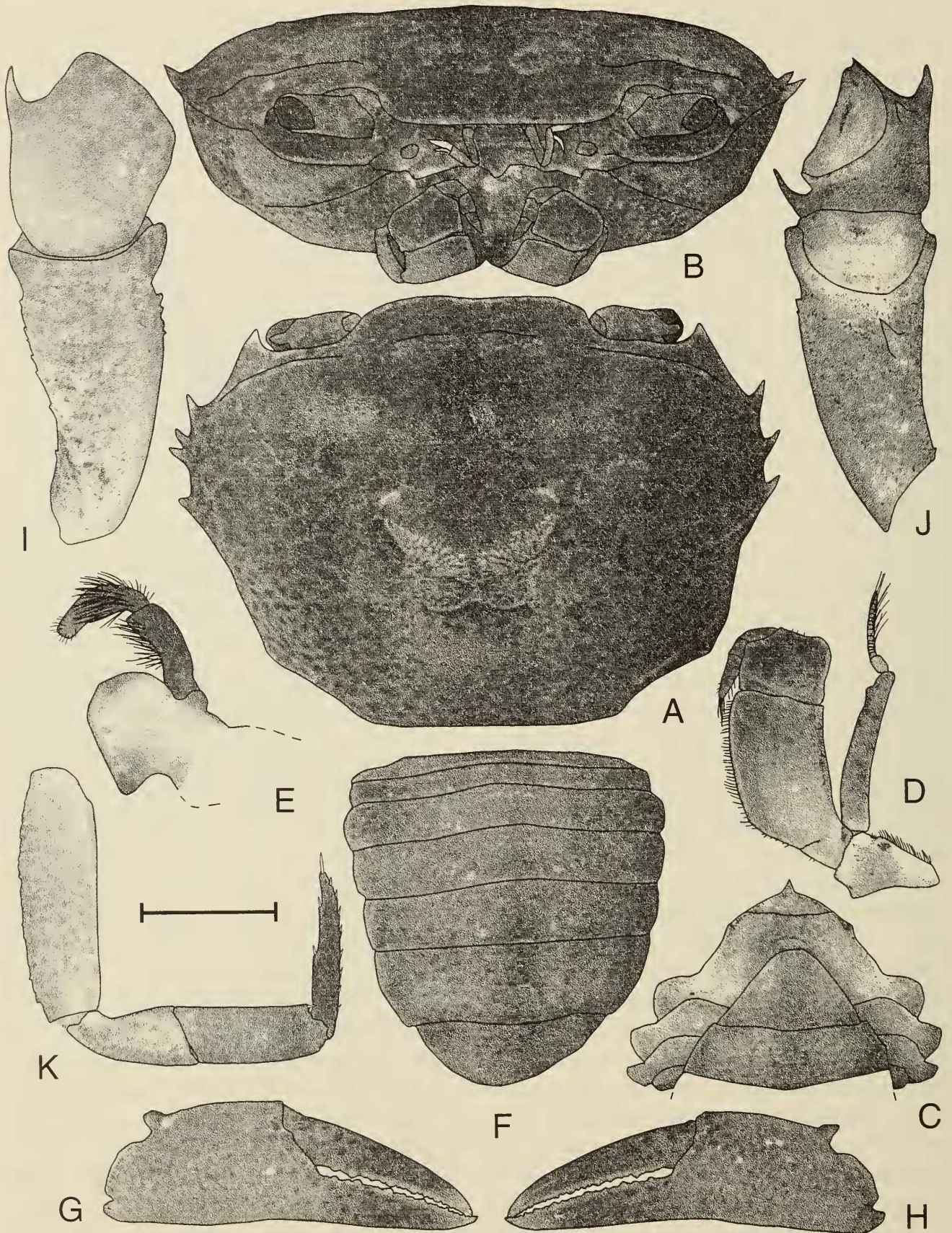


Fig. 3. *Potamonautes paecilei* (A. Milne-Edwards, 1886). Female, cw 18.6 mm, AMNH 17827. A, carapace and eyes, dorsal view; B, cephalothorax, carapace and eyes, frontal view; C, anterior sternum; D, left third maxilliped; E, left mandible; F, abdomen; G, right cheliped, frontal view; H, left cheliped, frontal view; I, carpus and merus of right cheliped, lateral view; J, carpus and merus of right cheliped, mesial view; K, left second pereiopod, lateral view. Scale = 2.2 mm (E), 3.3 mm (D, I, J), 4.4 mm (A, B, F-H, K), and 5.9 (C).

illiped is smooth and a vertical sulcus is lacking.

The sidewall of the carapace of the specimens from the Central African Republic has a distinct vertical sulcus which continues downward across the pterygostomial region, dividing the carapace sidewall into four parts. This contrasts with the type from the Republic Populaire du Congo where the sidewall of the carapace is divided into only three parts.

Ecology.—The specimens from the Central African Republic were netted in a small stream (1–2 m deep), with swiftly moving black water flowing over fine sand and mud.

Distribution.—Republic Populaire du Congo, and Democratic Republic of Congo. The Yobé river is a tributary of the Sangha river which drains southwestern Central African Republic and forms part of the border between the Central African Republic and Cameroon, and then between Cameroon and Republic Populaire du Congo, before joining the Zaire river in a broad marshy area at Mossaka, Republic Populaire du Congo. The type locality lies on the Alima river which flows into the Zaire river just to the south of Mossaka and contributes to the same expanse of marsh and wetlands as the Sangha river.

Sudanonautes Bott, 1955

Sudanonautes Bott, 1955:295.—Cumberlidge, 1999:172–176.

Diagnosis.—Intermediate tooth on anterolateral margin between epibranchial tooth and exorbital angle. Postfrontal crest prominent, almost horizontal, complete, with lateral ends meeting anterolateral margins. Carapace sidewall divided by two sulci into three parts. Mandibular palp two-segmented; terminal segment consisting of large oval posterior lobe (in three species there a small but distinct anterior process at junction between segments). Long, plumose flagellum on exopod of third maxilliped in all species. Sternal sulcus s3/s4 represented only by two short notches at sides of sternum. Terminal

article of gonopod 1 very long (at least two-thirds as long as subterminal segment). Terminal article of gonopod 1 either slim and needle-like (where longitudinal groove not visible) or broadened in middle (the result of a higher medial fold) with longitudinal groove visible at least for part of length. Terminal article of gonopod 2 very short, one-fifteenth length of subterminal segment.

Distribution.—The genus is present in Côte-d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Gabon, Bioko (Fernando Po), Central African Republic, Congo, Zaire, northern Angola, and southwest Sudan. The eleven species of *Sudanonautes* are found in the inland waters of West and Central Africa in a region bounded by Côte-d'Ivoire, southwest Sudan, and northern Angola. This area includes the Upper Guinea rainforests, the Lower Guinea forest together with the savannas of the eastern part of West Africa, and the offshore island of Bioko. In Central Africa seven species of *Sudanonautes* (*S. africanus*, *S. aubryi*, *S. floweri*, *S. granulatus*, *S. chavanesii*, *S. faradjensis*, and *S. sangha*) share the rivers and forests with species of *Potamonautes* and *Erimetopus* A. Milne-Edwards, 1886 (Bott 1955, Cumberlidge 1999).

Sudanonautes africanus (A. Milne-Edwards, 1869)

Thelphusa africana A. Milne-Edwards, 1869:186, pl. XI, figs. 2, 2a,b.—A. Milne-Edwards, 1887:124–126, pl. IV, fig. 8.

Potamon (Potamonautes) africanus: de Man, 1903:41, pl. IX, figs. 7–9.—Rathbun, 1904, pl. 16, fig. 6.—Rathbun, 1905:188–190, fig. 47.—Balss, 1929:124–125, figs. 5–7.—Balss, 1936:166.

Potamon (Potamonautes) africanum: Colosi, 1920:34.—Colosi, 1924:21, fig. 16.—Roux, 1927:237.

Potamon africanus: Chace, 1942:204.—Cappart, 1954:824, figs. 1, 6.

Sudanonautes (Sudanonautes) africanus africanus: Bott, 1955:295–298, figs. 61, 93–95, 103 a–d, pl. 24, figs. 2a–c, 3.—Bott, 1959:1004–1005.—Monod, 1977:1216

(not figs. 93–95, 102).—Monod, 1980: 384, pl. V, fig. 27.

Sudanonautes africanus: Cumberlidge, 1995a:588–598, figs. 1–3, table 1.—Cumberlidge, 1999:181–184, figs. 30B, 32B, 33B, 34B, 35C, 36E, 37C, 53P, 54–57, 60B, 67A, table IX.

Type material.—The holotype used by A. Milne-Edwards (1869) to describe *Thelphusa africana* was a small juvenile (MNHN) (cw 17 mm) collected from Gabon by M. Aubry-Lecomte. A more detailed description by A. Milne-Edwards (1887) was based on a larger, but still subadult female (MNHN) (cw 53 mm) collected from the river Ogoué, Congo (=Gabon). Because neither of these specimens was suitable to re-describe the species (one is a juvenile and the other a subadult female), and because no topotypes were available, the species was re-described by Cumberlidge (1995a) from an adult male (cw 83 mm) from Cross River State, Nigeria (NMU 9.IV.1983), and an adult female (cw 108 mm) from a tributary of the Ikpan river, Cross River State, Nigeria (NMU 5.IV.1983).

Material examined.—Central African Republic. Ten specimens, sub-adults and juveniles (no adults) (AMNH 18033), 19.5 km from the village of Bayanga (03°05'27"N, 16°16'40"E), Mapoyo (Mboyé) creek, depth 1–1.5 m, either on muddy bottom, or in burrows in overhanging banks, coll. M. Lawrence, J. Sullivan, and local residents, 17 Jun 1998. Four specimens, 1 adult male and 3 juveniles (AMNH 18034), about 5 km from the village of Bayanga, Mobeya [Moubia?] creek, upstream of mouth, depth 0.5–1 m, sandy, gravely and muddy pools, in burrows in overhanging banks, among roots, under logs, coll. M. Lawrence and local residents, 26 Jun 1998. One subadult male (AMNH 18035), 19.5 km from the village of Bayanga (03°05'27"N, 16°16'40"E), Mapoyo (Mboyé) creek, depth 1–1.5 m, on muddy bottom, or in burrows in overhanging banks, coll. M. Lawrence, J. Sullivan, and local residents, 17 Jun 1998. Four specimens, all juveniles

(AMNH 18036), about 5 km from the village of Bayanga, Mobeya [Moubia?] creek, upstream of mouth, depth 0.5–1 m, sandy, gravely and muddy pools, in burrows in overhanging banks, among roots, under logs, coll. M. Lawrence, J. Sullivan, and J. B. Kindimoungo, 28 Jun 1998.

Type locality.—Gabon.

Diagnosis.—Carapace relatively flat (ch/fw 1.06). Postfrontal crest smooth almost straight; spanning entire carapace, meeting anterolateral margins at epibranchial teeth; posterior surface of carapace in cardiac and branchial regions with patches of raised circular blisters, lateral parts with fields of raised short lines (carinae); semi-circular, cardiac, urogastric grooves very deep. Proximal region of pollex of propodus of major cheliped of adult with large, conspicuously flattened tooth. Exorbital angle tooth large, triangular; intermediate tooth large, triangular blunt, as big as exorbital angle tooth. Epibranchial tooth small, about half size of intermediate tooth and exorbital angle tooth. Anterolateral margin behind epibranchial tooth smooth. Terminal article of gonopod 1 thin, needle-like, subterminal segment of gonopod 1 slim. This is the largest species of freshwater crab in Africa. Adult sizes range from the size at the pubertal molt (cw 70–75 mm) to largest the known specimen (cw 113 mm).

Description.—For a detailed description see Cumberlidge (1995a, 1999). For a brief description of the type see Capart (1954, figs. 1, 6).

Remarks.—*Sudanonautes africanus* is a common and well-known species that was recently re-described (Cumberlidge 1995a, 1999).

Ecology.—This species is restricted to the more humid areas of the coastal rainforest belt from south-east Nigeria to the mouth of the Zaire river. *Sudanonautes africanus* occurs in a range of permanent aquatic habitats from large rivers and small streams (with both fast and slow flowing water) to ponds. In the Central African Republic *S. africanus* is found in creeks up to 1.5 m deep with a

sand, gravel or mud bottom. Specimens were also taken from burrows in overhanging banks, among roots and under logs. Elsewhere in its range, this species is also common in streams and rivers draining mature forest, and has been reported to dig burrows near waterways. This crab also occurs in temporary water sources such as drainage culverts and ditches. For more details see Cumberlidge (1995a, 1999).

Distribution.—*Sudanonautes africanus* occurs in the coastal rainforest regions of Nigeria and Central Africa. In Central Africa *S. africanus* occurs in south Cameroon, the Republic Populaire du Congo, and Gabon (in the San Benito, Ogoué and Alima rivers), and in the lower reaches of the Zaire River basin. For more details see Cumberlidge (1995a, 1999). The present record is the first report of the presence of *S. africanus* in the Central African Republic.

Sudanonautes sangha, new species

Fig. 4

Type material and type locality.—Central African Republic. Holotype: 1 subadult female, cw 40.5, cl 29.7, ch 12.5, fw 10.7 mm (AMNH 17825), a few km upstream from the village of Bayanga (02°45'43"N, 16°14'12"E), Sangha river, depth 1–2 m, in fish trap, eating worm, coll. J. Sullivan and J. B. Kindimoungo, 18 Jun 1998.

Diagnosis.—Exorbital tooth large, pointed; intermediate tooth small, low; epibranchial tooth small, low, not directed outward, set back behind mid-point of postfrontal crest. Postfrontal crest spanning entire carapace, crest curving backward before meeting epibranchial tooth, anterolateral margin posterior to epibranchial tooth raised, lined by small granules. Semi-circular, urogastric, transverse branchial grooves very deep. Vertical suture on carapace sidewall meeting intermediate tooth. Carapace medium height (ch/fw = 1.16). Mandibular palp two-segmented; terminal segment single, undivided, with hair at junction between segments. First carpal tooth on carpus of cheliped large,

pointed; second carpal tooth reduced to small granule.

Description.—Carapace (Figs. 4A, B).—Ovoid, widest in anterior third (cw/fw 3.79), medium height (ch/fw = 1.16), semi-circular, urogastric, transverse branchial grooves very deep, regions smooth; cardiac region weakly marked, cervical grooves present but weak. Front slightly bilobed, anterior margin indented, relatively narrow, about one-quarter carapace width (fw/cw = 0.26) (Fig. 4B). Postfrontal crest smooth, spanning entire carapace, straight part consisting of fused epigastric, postorbital crests, then curving backward behind intermediate teeth to meet anterolateral margins at epibranchial teeth. Anterolateral margin smooth posterior to epibranchial tooth. Exorbital tooth large, sharp, pointed forward. Epibranchial tooth low, small, set back behind mid-point of postfrontal crest.

Carapace sidewalls mostly smooth, with faint granules in suborbital regions. Each sidewall with two sutures, one longitudinal, one vertical, dividing sidewall into three parts. Longitudinal (epimeral) suture dividing suborbital, subhepatic regions from pterygostomial region, beginning medially at lower margin of orbit, curving backward across flank. Short vertical suture dividing suborbital region from subhepatic region; vertical suture meeting intermediate tooth. First transverse groove on sternum, between sternal segments s2 and s3, complete; second groove, between sternal segments s3 and s4, consisting of two small notches at sides of sternum. Third maxillipeds filling entire oral field, except for transversely oval efferent respiratory openings at superior lateral corners; long flagellum on exopod of third maxilliped; ischium of third maxilliped smooth, with clear vertical groove (Fig. 4C). Mandibular palp two-segmented; terminal segment single, undivided, with hair but no hard flap at junction between segments (Fig. 4D). Segments 1–6 of female abdomen four-sided, last segment a broad rounded triangle, sides forming a smooth curved, rounded margin; segments 5–6 broadest (Fig. 4E).

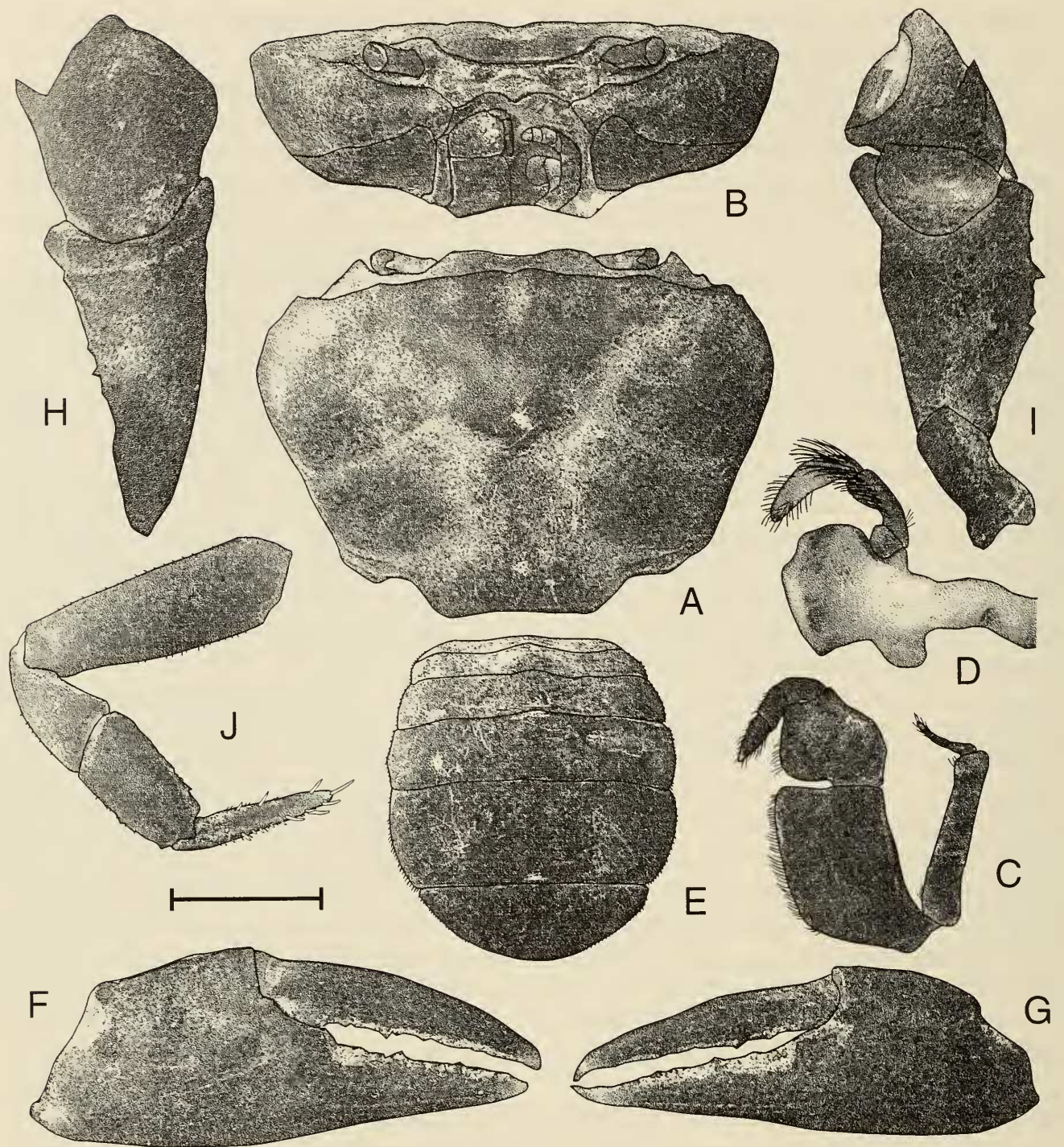


Fig. 4. *Sudanonautes sangha*, new species. Holotype subadult female, cw 40.5 mm, AMNH 17825. A, carapace and eyes, dorsal view; B, cephalothorax, carapace and eyes, frontal view; C, left third maxilliped; D, left mandible; E, abdomen; F, right cheliped, frontal view; G, left cheliped, frontal view; H, carpus and merus of right cheliped, lateral view; I, carpus and merus of right cheliped, mesial view; J, left second pereopod, lateral view. Scale = 4.4 mm (D), 6.2 mm (I), 6.7 mm (C), 7.2 mm (H), 8.6 mm (F, G, J), and 12.7 mm (A, B, E).

Dactylus of right cheliped long, slim, straight; palm of propodus swollen; fingers of digits of chelipeds with small even teeth, forming long slim interspace when closed, fingers almost meeting when shut (Fig. 4F). Inferior margins of merus with rows of small

granules, cluster of granules surrounding larger pointed distal meral tooth at distal end (Fig. 4I). Inner margin of carpus of cheliped with large, slender, pointed tooth (first carpal tooth), second carpal tooth reduced to a granule (Fig. 4I). Pereiopods P2–P5 slender

(Fig. 4J), P4 longest, P5 shortest. Propodus of P2–P5 broad, posterior margin of propodus of P2–P5 serrated, dactyli of P2–P5 tapering to point, each bearing four rows of downward-pointing sharp bristles; dactylus of P5 shortest.

Etymology.—The species is named for the Sangha river where it was collected. The Sangha river drains a large region of the Central African Republic, and is a dominant natural feature of the area. The species name *sangha* is a noun in apposition.

Remarks.—It is not normally good practice to describe a new species from a subadult female. However, we have decided to establish this taxon in light of the distinct nature of the available morphological characters, and because of the isolated nature of the study area which may mean that further specimens are unlikely to become available for some time. *Sudanonautes sangha* is the eleventh species of this West and Central African genus. Characters of the gonopods, adult male chelipeds, abdomen and sternum are not available because the only specimen of *S. sangha* is a subadult female. Nevertheless, there are a number of unique characters that distinguish *S. sangha* from other species in the genus.

Sudanonautes sangha is most likely to be confused with other large species of freshwater crabs occurring in the rain forests of Central Africa such as *S. chavanesii*, *S. faradjensis*, *S. africanus*, *S. aubryi* and *S. floweri*.

Sudanonautes sangha and *S. africanus* are similar in that both species have a small epibranchial tooth, and both lack large teeth on the anterolateral margins of the carapace. However, there are a number of characters which distinguish *S. sangha* from *S. africanus*. The carapace of *S. sangha* is not as flattened as that of *S. africanus* (ch/fw *S. sangha* = 1.16, *S. africanus* = 1.06), and the posterior region of the carapace of *S. sangha* is smooth, whereas that of *S. africanus* is rough with warty patches and ridges in the posterior region. The cardiac regions of *S. sangha* are flattened and are neither rounded

nor well marked, whereas these regions in *S. africanus* appear as a pair of distinct raised rounded structures that are clearly outlined by deep cardiac grooves. The intermediate tooth on the anterolateral margin between the exorbital tooth and the epibranchial tooth of *S. sangha* is small and low, whereas that of *S. africanus* is large and triangular. The second carpal tooth on the cheliped of *S. sangha* is very small, only the size of a granule, whereas the second carpal tooth of *S. africanus*, while smaller than the first carpal tooth, is distinct, pointed, and is a tooth rather than a granule. The vertical groove on the carapace sidewall of *S. sangha* meets the anterolateral margin at the base of the intermediate tooth, whereas the vertical groove of *S. africanus* meets the anterolateral margin at the base of the epibranchial tooth.

Sudanonautes sangha can be distinguished from *S. chavanesii* by the position of the postfrontal crest and by the shape of the epibranchial teeth. In *S. sangha* the lateral ends of the postfrontal crest curve forward to meet the epibranchial teeth in line with the mid groove of the crest, whereas in *S. chavanesii* the lateral ends of the postfrontal crest curve sharply backward before meeting the epibranchial teeth which are set back posterior to the mid groove of the crest. In *S. sangha*, the epibranchial tooth is small, blunt, pointed forward, and positioned in line with the mid groove of the crest, whereas in *S. chavanesii*, the epibranchial tooth is large, sharp, pointed outward, and positioned well behind the mid-groove of the postfrontal crest. Further, in *S. sangha* the vertical suture on the carapace sidewall is simple, whereas in *S. chavanesii* the vertical suture on the carapace sidewall forms a Y-shaped depression beneath the intermediate tooth. Finally, in *S. sangha* the junction between the two segments of the mandibular palp is simple, whereas in *S. chavanesii* there is a small hard flap on the mandibular palp at the junction between the two segments.

Sudanonautes sangha can be distinguished from *S. faradjensis* by the form of

the anterolateral margin behind the epibranchial tooth: that of *S. sangha* is raised and lined by small granules, whereas in *S. faradjensis*, there is a row of sharp teeth. *Sudanonautes sangha* can be distinguished from *S. granulatus* as follows: the exorbital tooth of *S. sangha* is wide and triangular, whereas that of *S. granulatus* is narrow and low, and the anterolateral margin of *S. sangha* is raised and lined by granules, whereas that of *S. granulatus* is completely smooth.

Sudanonautes sangha can be distinguished from *S. aubryi* by differences in the postfrontal crest: that of *S. sangha* meets the anterolateral margin at the epibranchial tooth, whereas that of *S. aubryi* meets the anterolateral margin behind the epibranchial tooth. In addition, the carapace of *S. sangha* is distinctly flatter than that of *S. aubryi* (ch/fw *S. sangha* = 1.16, *S. aubryi* = 1.29).

Finally, *S. sangha* can be distinguished from *S. floweri* by differences in the mandibular palp: in *S. sangha* the junction between the two segments of the mandibular palp is simple, whereas in *S. floweri* there is a small hard flap on the mandibular palp at the junction between the two segments. In addition, the carapace of *S. sangha* is distinctly flatter than that of *S. floweri* (ch/fw *S. sangha* = 1.16, *S. floweri* = 1.68).

Ecology.—Collected in a large river (as opposed to a small stream), and caught in a baited trap.

Distribution.—Central African Republic, a few kilometers upstream from the village of Bayanga (02°45'43"N, 16°14'12"E), Sangha river.

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Literature Cited

- Balss, H. 1914. Potamonidenstudien.—Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Thiere, 37:401–410.
- . 1929. Crustacea V. Potamonidae. Pp. 115–129 in Th. Monod, ed., Contributions à l'étude de la faune du Cameroun. Faune des Colonies françaises Paris 3.
- . 1936. Beiträge zur Kenntnis der Potamidae (Süßwasserkrabben) des Kongogebeites.—Revue Zoologique et Botanique d'Afrique 28:165–204.
- Bott, R. 1955. Die Süßwasserkrabben von Afrika (Crust., Decap.) und ihre Stammesgeschichte.—Annales du Musée du Congo belge, (Tervuren, Belgique) C-Zoologie (3,3), 3(1):209–352.
- . 1959. Potamoniden aus West-Afrika (Crust., Dec.).—Bulletin de l'Institut français d'Afrique noire 21, série A (3):994–1008.
- . 1960. Crustacea (Decapoda): Potamonidae. Pp. 13–18 in B. Hansström & others, South African Animal Life.—Results of Lund University Expedition in 1950–1952, 7.
- . 1964. Decapoden aus Angola unter besonderer Berücksichtigung der Potamoniden (Crust. Decap.) und einem Anhang: Die Typen von *Thelphusa pelii* Herklots, 1861.—Publicações culturais da Companhia de Diamantes de Angola, Lisboa 69:23–34.
- . 1968. Decapoden aus dem Museu do Dundo (Crust. Decap.).—Publicações culturais da Companhia de Diamantes de Angola, Lisboa 77:165–172.
- . 1970. Betrachtungen über die Entwicklungsgeschichte und Verbreitung der Süßwasser-Krabben nach der Sammlung des Naturhistorischen Museums in Genf/Schweiz.—Revue suisse de Zoologie 77:327–344.
- Capart, A. 1954. Révision des types des espèces de Potamonidae de l'Afrique Tropicale conservés au Muséum d'Histoire Naturelle de Paris.—Volume Jubilaire de Victor Van Strahlen, Director de l'Institut royal des Sciences naturelles de Belgique, 1925–1934 II:819–847.
- Chace, F. A. 1942. II. Decapod Crustacea. Pp. 185–233 in Scientific results of the fourth expedition to forested areas in eastern Africa.—Bulletin of the Museum of Comparative Zoology, Harvard College 91(3).
- Colosi, G. 1920. I Potamonidi conservati del R. Museo Zoologico di Torino.—Bolletino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino, 35(734):1–39.
- . 1924. Potamonidés africains du Muséum de Stockholm.—Arkiv für Zoologie 16:1–24.
- Cumberland, N. 1993. Redescription of *Sudanonautes granulatus* (Balss, 1929) (Potamoidea, Potamonautidae) from West Africa.—Journal of Crustacean Biology 13:805–816.

- . 1994. Identification of *Sudanonautes aubryi* (H. Milne Edwards, 1853) (Brachyura: Potamoidea: Potamonautidae) from West and Central Africa.—*Zeitschrift für Angewandte Zoologie* 80:225–241.
- . 1995a. Redescription of the African freshwater crab *Sudanonautes africanus* (A. Milne-Edwards, 1869) (Brachyura: Potamoidea: Potamonautidae).—*Journal of Crustacean Biology* 15: 588–598.
- . 1995b. Remarks on the taxonomy of *Sudanonautes chavanesii* (A. Milne-Edwards, 1886) (Brachyura: Potamoidea: Potamonautidae) from Central Africa.—*Proceedings of the Biological Society of Washington* 108:238–246.
- . 1995c. Redescription of the Central African freshwater crab *Sudanonautes faradjensis* (Rathbun, 1921) (Brachyura: Potamoidea: Potamonautidae).—*Proceedings of the Biological Society of Washington* 108:629–636.
- . 1995d. Redescription of *Sudanonautes floweri* (De Man, 1901) (Brachyura: Potamoidea: Potamonautidae) from Nigeria and Central Africa.—*Bulletin of the British Museum of Natural History (Zoology)*, London 61:111–119.
- . 1999. The freshwater crabs of West Africa. Family Potamonautidae. Pp. 1–382, *Faune et Flore Tropicales* 35, IRD, Paris.
- Daniels, S. R., B. A. Stewart, & M. J. Gibbons, 1998. *Potamonautes granularis* sp. nov. (Brachyura: Potamonautidae), a new cryptic species of river crab from the Olifants river system, South Africa.—*Crustaceana* 71:885–903.
- Harvey, A. W. 1999. Techniques for computer aided biological illustration. Meeting Program, The Crustacean Society, 1999 Summer Meeting, Lafayette, Louisiana: 33 (abstract).
- Macleay, W. S. 1838. Brachyurous Decapod Crustacea. Illustrations of the Zoology of South Africa 5; being a Portion of the Objects of Natural History Chiefly Collected during an Expedition into the Interior of South Africa, under the Direction of Dr. Andrew Smith, in the Years 1834, 1835, and 1836; Fitted Out by “The Cape of Good Hope Association for Exploring Central Africa.” Pp. 1–75 in A. Smith, Illustrations of the Zoology of South Africa; Consisting Chiefly of Figures and Descriptions of the Objects of Natural History Collected During an Expedition into the Interior of South Africa, in the Years 1834, 1835, and 1836; Fitted Out by “The Cape of Good Hope Association for Exploring Central Africa.” (Invertebrates).
- Man, J. G., de. 1901. Description of a new fresh-water Crustacea from the Soudan; followed by some remarks on an allied species.—*Proceedings of the Zoological Society of London* 1901:94–104.
- . 1903. On *Potamon* (*Potamonautes*) *latidactylum*, a new fresh-water crab from Upper Guinea.—*Proceedings of the Zoological Society of London* 1:41–47.
- Milne-Edwards, A. 1869. Révision du genre *Thelphusa* et description de quelques espèces nouvelles faisant partie de la collection du Muséum.—*Archives du Muséum d’Histoire naturelle Paris* 5: 161–190.
- . 1886. La description de quelques Crustacés du genre *Thelphusa* recueillis par M. de Brazza dans les régions du Congo.—*Bulletin de la Société Philosophique Paris séries* 7(10):148–151.
- . 1887. Observations sur les crabes des eaux douces de l’Afrique.—*Annales des Sciences Naturelles, Zoologie Paris* (7)4:121–149.
- Milne Edwards, H. 1853. Mémoire sur la famille des Ocypodiens.—*Annales des Sciences Naturelles, Zoologie et Paléontologie sér.* 3, 20:163–228, pls. 6–11.
- Monod, T. 1977. Sur quelques crustacés Décapodes africains (Sahel, Soudan).—*Bulletin de Muséum national d’Histoire naturelle Paris*, 3, 500:1201–1236.
- . 1980. Décapodes. Pp. 369–389. Ed. J. R. Durand and C. Lévêque. In *Flore et Faune Aquatiques de l’Afrique Sahelo-Soudanienne* 1, ORSTOM, I.D T., Paris 44.
- Ortmann, A. E. 1897. Carcinologische Studien.—*Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie de Thiere* 10:256–372.
- Rathbun, M. J. 1904. Les crabes d’eau douce (Potamonidae).—*Nouvelles Archives du Muséum d’Histoire naturelle (Paris)* 6(4):255–312.
- . 1905. Les crabes d’eau douce (Potamonidae).—*Nouvelles Archives du Muséum d’Histoire naturelle (Paris)* 7(4):159–322.
- . 1921. The brachyuran crabs collected by the American Museum Congo Expedition, 1909–1915.—*Bulletin of the American Museum of Natural History* 43(8):379–474.
- Roux, J. 1927. Note sur une collection de Crustacés décapodes du Gabon.—*Bulletin de la Société Vaudoise des Sciences naturelles* 56(218):237–244.
- Stewart, B. A. 1997a. Morphological and genetic differentiation between populations of river crabs (Decapoda: Potamonautidae) from the Western Cape, South Africa, with a taxonomic re-examination of *Gecarcinautes brincki*.—*Zoological Journal of the Linnean Society* 199:1–21.
- . 1997b. Biochemical and morphological evidence for a new species of river crab *Potamonautes parvispina* (Decapoda: Potamonautidae).—*Crustaceana* 70:737–753.
- Stewart, B. A., M. Coke, & P. A. Cook, 1995. *Potamonautes dentatus*, new species, a fresh-water crab (Brachyura: Potamoidea: Potamonautidae) from KwaZulu-Natal, South Africa.—*Journal of Crustacean Biology* 15:558.